

REMARKS

Claims 1-19 are pending in this Application. Claim 20 is added with this Amendment. Claims 14-16 stand allowed.

Claims 1 and 17 have been amended to correct minor informalities. Claim 1 has been further amended to recite depositing a metal-containing film on the substrate wherein the metal comprises germanium, silicon or mixtures thereof. Support for this is found in claim 1 itself where M is germanium or silicon and throughout the Specification such as at page 15, last 2 lines to page 16, line 1. Claim 11 has been amended to incorporate the limitation of claim 7. Newly added claim 20 is supported by the Specification at page 5, last line, and by original claim 11. No new matter is added with this Amendment.

Restriction

Claims 1-19 are subject to a restriction requirement as follows:

Group I - claims 1-4, 11-12, and 14-18 - directed to a method of depositing a metal-containing film using certain compounds;

Group II - claims 5-6 and 13 - directed to a device for depositing a metal-containing; and

Group III - claims 7-10 and 16.

Applicants affirm their election of Group I, claims 1-4, 11-12 and 14-18, with traverse.

The Official Action posits that Groups I and II are related as process and apparatus for its practice and that the apparatus as claimed can be used for a materially different process such as etching. Applicants respectfully disagree. Group I is directed to a method of depositing a germanium and/or silicon-containing film using certain germanium and/or silicon compounds. Group II is directed to a device for depositing germanium and/or silicon-containing films, wherein the device has a chamber that contains the same germanium and/or silicon compounds recited in Group I. Accordingly, such device of Group II cannot be used for etching. The only process for which the device of Group II can be used is the deposition of a metal-containing film as recited in the claims of Group I.

The Official Action posits that Groups II and III are related as apparatus and product and that the product can be made by another and materially different apparatus such as a plasma apparatus. Applicants respectfully disagree. Group II is described above. Group III is directed

to certain germanium compounds. The apparatus of Group II is used to deposit germanium and or silicon-containing films on a substrate. Group III claims certain organogermanium compounds, *not* films. Thus, Group III does not claim a product made by the apparatus of Group II. Further, a plasma process would decompose organogermanium compounds, not make them.

The Official Action posits that Groups I and III are related as process of making and product made and that the product as claimed can be made by another and materially different process such as sputtering. Applicants respectfully disagree. As discussed above, Group I is directed to the vapor deposition of germanium and/or silicon-containing films. Group III is directed to certain germanium organometallic compounds, *not* films. The compounds of Group III cannot be made by sputtering. A sputtering process decomposes organometallic compounds, not prepares them.

In view of the foregoing, Applicants respectfully request withdrawal of this restriction and rejoinder of Groups I-III.

Objections

Claims 1 and 17 have has been objected to because of certain informalities. Applicants submit that this objection is mooted by the present amendment and respectfully request that this objection be withdrawn.

35 USC §112

Claims 1-4, 11-12 and 17-18 have been rejected under 35 USC §112, second paragraph as being indefinite for failing to point out particularly and claim distinctly the subject matter which Applicants regard as their invention. Applicants respectfully traverse.

Claim 1 has been further clarified by amending it to recite that none of R³ is cyclopentadienyl. The Official Action also points to a need for clarifying a limitation on lines 8-9 of claim 1, but fails to specify which limitation. In the event that the Official Action was referring to the limitation of "wherein R³ ≠ R⁴", such limitation means that R³ and R⁴ are different. When more than one R³ and/or R⁴ are present, this limitation means that none of the R⁴ groups are the same as and of the R³ groups, that is that the R³ and R⁴ groups are different.. This meaning would be easily understood by those skilled in the art.

Applicants submit that the amendments to claims 11 and 17 make moot this rejection. Applicants respectfully request that this rejection be withdrawn.

35 USC §103

Claims 1-4, 11-12 and 17-18 have been rejected under 35 USC §103(a), as being unpatentable over US 6,589,329 (Baum et al.) or US 6,359,159 (Welch et al.) or US 6,310,228 (Itsuki et al.). Applicants respectfully traverse.

US 6,589,329 (Baum et al.) is directed to certain copper precursors for vapor deposition and methods of depositing copper films on a substrate using the certain precursors. Only copper containing compounds are disclosed. Likewise, only methods of depositing copper films are disclosed. The Official Action indicates that "a large list of precursors is cited (cols. 4-6)" in this patent. However, this patent does not disclose a list of precursors, rather it discloses a list of possible ligands for the certain copper precursors. This patent neither teaches nor suggests the deposition of any metal film except for copper films. See, e.g., column 4, at lines 22-23 ("In another respect, the invention relates to a process for the production of copper, . . ."), lines 30-31 ("In another respect, the invention relates to a process for the production of copper, . . ."), lines 38-39 ("Other aspects of the invention relate to the copper made by the process of this invention . . ."), and lines 42-43 ("The precursor compositions of this invention are useful [sic] for the manufacture of copper, . . ."). Even the title of the Baum patent makes clear that this patent is directed to copper: "Composition and Process for Production of **Copper** Circuitry in Microelectronic Device Structures". (Emphasis added.) It is very plain reading the Baum patent that no other metals (or metalloid) compounds are suggested. In particular, since the Baum patent is directed to the deposition of copper circuitry, only copper-containing compounds are useful as other metal-containing compounds cannot be used to deposit copper. One skilled in the art reading this patent would only realize that certain copper compounds can be used to deposit copper circuitry. Nothing in this patent teaches or suggests that other metals or metalloids can be used to deposit metal films. More particularly, this patent neither teaches nor suggests the deposition of germanium films, silicon films, or mixtures thereof.

In contrast to the Baum patent, the present invention is directed to methods of depositing metal-films comprising germanium, silicon and mixtures thereof. See present claim 1 wherein M

= Ge or Si. Germanium and silicon are Group IVA (i.e. Group 14 using IUPAC nomenclature) compounds and are classified as metalloids. Copper, on the other hand is a transition metal of Group Ib (or Group 11 using IUPAC nomenclature). The properties of elemental germanium and elemental silicon are very different from elemental copper. Likewise, the properties of organogermanium compounds and organosilicon compounds are very different from organocopper compounds. The uses of germanium and silicon are not interchangeable with copper. Accordingly, the organometallic compounds of germanium and silicon are not interchangeable with copper. One skilled in the art seeking germanium or silicon precursors would not look to the copper compounds of Baum. While certain of the copper precursors of Baum do contain a silicon ligand, Baum clearly teaches that these compounds deposit a copper film and not the silicon, germanium or mixture thereof film required by the present claims. Thus, the Baum patent teaches away from the presently claimed invention. Still further, all of the copper compounds of Baum *require* "hfac" as a ligand. "Hfac" is "1,1,1,5,5,5-hexafluoroacetylacetonato". Such a ligand is not included within the present claims. It is clear from the present claims and Specification that the only substituents on the alkyl, alkenyl, alkynyl or aryl groups are halogen. See page 7, lines 12-14.

US 6,359,159 (Welch et al.) is directed to certain silicon and germanium compounds having a β -diketonate-type structure. In these certain compounds, the β -diketonate-type ligand is *required*. This patent fails to disclose or suggest any precursor compounds that do not have such structures. As discussed above, the present claims do not include such β -diketonate-type ligands. It is clear from the present claims and Specification that the only substituents on the alkyl, alkenyl, alkynyl or aryl groups are halogen. See page 7, lines 12-14. More particularly, the Welch patent fails to disclose or suggest a method of depositing metal-containing films using the organometallic compounds as claimed by Applicants in claims 11-12, 17-18 and 20.

US 6,310,228 (Itsuki et al.), like the Baum patent discussed above, is directed to certain copper precursors for vapor deposition and methods of depositing copper films on a substrate using the certain precursors. Only copper containing compounds are disclosed. Likewise, only methods of depositing copper films are disclosed. The Official Action indicates that "a large list of precursors is cited (cols. 4-6)" in this patent. However, this patent does not disclose a list of precursors, rather it discloses a list of possible ligands for the certain copper precursors. This

patent neither teaches nor suggests the deposition of any metal film except for copper films. See, e.g., column 1, at lines 9-10 ("The present invention relates to organic compounds for making copper (Cu) thin-films ..."), and lines 61-61 ("The present invention provides a copper based organic compound ..."), and column 2 at lines 3-4 ("A first aspect of the present invention relates to an organic copper compound ..."), lines 27-28 ("A second aspect of the present invention relates to an organic copper compound ..."), and lines 65-66 ("A third aspect of the present invention relates to an organic copper compound ..."). Even the title of the Itsuki patent makes clear that this patent is directed to copper: "Organic Copper Compound, Liquid Mixture Containing the Compound, and Copper Thin-Film Prepared Using the Solution." (Emphasis added.) It is quite clear reading this patent that no other metal (or metalloid) compounds are suggested for vapor deposition. In particular, since the Itsuki patent is directed to the deposition of copper thin-films, only copper-containing compounds are useful as other metal-containing compounds cannot be used to deposit copper. One skilled in the art reading this patent would only realize that certain copper compounds can be used to deposit copper thin-films. Nothing in this patent teaches or suggests that other metals or metalloids can be used to deposit metal films. More particularly, this patent neither teaches nor suggests the deposition of germanium films, silicon films, or mixtures thereof.

As discussed above, the present invention relates to the deposition of metal-films containing germanium, silicon or mixtures thereof. The properties of germanium and silicon compounds are quite different from those of copper compounds. One skilled in the art would know that such compounds are not interchangeable. The mere fact that copper thin-films can be deposited using certain copper precursors in no way teaches or suggests that certain germanium and silicon compounds can be used to deposit metal films containing germanium, silicon and mixtures thereof. While certain of the copper precursors of Itsuki do contain a silicon ligand, Itsuki clearly teaches that these compounds deposit a copper film and not the silicon, germanium or mixture thereof film required by the present claims. Thus, the Itsuki patent teaches away from the presently claimed invention.

Based on the foregoing, Applicants submit that the Examiner has not made out a prima facie case of obviousness and respectfully request that this rejection be withdrawn.

Allowed Claims

Claims 14-16 stand allowed as the prior art fails to teach or suggest the use of isobutylgermane as a precursor to deposit a metal-containing film onto a substrate. See Official Action at page 7. Applicants submit that claim 17, which also explicitly requires the use of isobutylgermane, and claim 18 depending therefrom, should be found allowable for the same reasons as claims 14-16.

Double Patenting

The MPEP describes the background and proper usage of nonstatutory double patenting rejections as follows:

A rejection based on nonstatutory double patenting is based on a judicially created doctrine grounded in public policy so as to prevent the unjustified or improper timewise extension of the right to exclude granted by a patent [citations omitted]. MPEP §804(II)(B)(1).

Obviousness-type double patenting requires rejection of an application claim when the claimed subject matter is not patentably distinct from the subject matter claimed in a commonly owned patent, ... when the issuance of a second patent would provide unjustified extension of the term of the right to exclude granted by a patent. [Citations omitted]. [Emphasis in original]. MPEP §804(II)(B)(1).

Claims 1-4, 11-12, 14-18 have been rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-4 and 11-16 of copending application serial no. 11/316,466 ("the '466 Application"). The Official Action states at page 8 that although the conflicting claims are not identical, they are not patentably distinct from each other because the elimination of a mole percentage is an obvious variation. Applicants respectfully traverse.

The present invention has a priority date of April 5, 2003 and a filing date of April 2, 2004. The '466 has a priority date of December 19, 2005 and a filing date of December 22, 2005. The present application is the earlier filed application by more than 1.5 years. Thus, the present application will naturally expire more than 1.5 years before the '466 Application. Applicants submit that this rejection is improper because the rejected claims would in no way provide an improper timewise extension of the right to exclude others from any of claims 1-4 and

11-16 of the '466 Application which may grant. Currently, claims 1-4 and 15-16 of the '466 Application stand rejected.

Applicants submit that a 2-way test for obviousness-type double patenting is proper given that the present application is the earlier filed application by more than 1.5 years and the length of the pendency of the present case. That is, for their to be obviousness-type double patenting, the present claims and claims 1-4 and 11-16 of the '466 Application must each be obvious in view of the other. Claims 1-4 and 11-16 of the '466 Application are directed to a method of depositing a germanium film on a substrate by conveying in the gaseous phase a certain germanium-containing compound and a certain modifying compound (which does not contain germanium) in an amount of up to 0.25 mol% based on the germanium compound. The modifying compound is a required element of claims 1-4 and 11-16 of the '466 Application. There is nothing in the present claims that teach or suggest the use of such a modifying compound at all in the deposition of a germanium-containing film. Applicants submit that this rejection is improper because the rejected claims would in no way provide an improper timewise extension of the right to exclude others from depositing a germanium-containing film as claimed in claims 1-4 and 11-16 of the '466 Application. Accordingly, Applicants respectfully request that this rejection be withdrawn.

Claims 1-4, 11-12, 14-18 have been rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-7 of copending application serial no. 11/237,999 ("the '999 Application"). The Official Action states at page 8 that although the conflicting claims are not identical, they are not patentably distinct from each other because the specification of a metal-containing film is an obvious variant. Applicants respectfully traverse.

The present claims are directed to a method of *depositing a metal-film on a substrate* using certain compounds of germanium and/or silicon. Thus, the metal-containing film deposited according to the present method contains germanium, silicon or mixtures thereof. Silicon and germanium are *Group IVA metals*. In stark contrast, claims 1-7 of the '999 Application are directed to a method of depositing a *Group IIIA* metal film on a substrate by conveying, in gaseous form, a certain Group IIIA metal compound, a Group VA compound and a

catalyst compound. Claim 1 of the '999 Application has been amended during prosecution to recite certain catalyst compounds, none of which contain germanium or silicon.

The present claims are only directed to depositing metal films comprising germanium, silicon or mixtures thereof. Claims 1-7 of the '999 Application are directed only to depositing films of a Group IIIA metal. Elements of Group IVA and Group IIIA have different properties and have entirely different uses. Compounds of these elements also possess different properties and are not interchangeable. The present claims and the claims of the '999 Application are clearly directed to very different inventions. There is no similarity whatsoever between the present claims and claims 1-7 of the '999 Application. It is a stretch to say the least to call claims 1-4, 11-12, 14-18 of the present application the same invention or an obvious variant thereof with respect to claims 1-7 of the '999 Application. Applicants submit that this rejection is improper because the rejected claims (of vapor depositing a metal-containing film on a substrate where the metal film comprises silicon, germanium or mixtures thereof) would in no way provide an improper timewise extension of the right to exclude others from depositing a Group IIIA metal-film on a substrate as claimed by the '999 Application. Accordingly, Applicants respectfully request that this rejection be withdrawn.

Claims 1-4, 11-12, 14-18 have been rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-15¹ of U.S. Pat. No. 7,045,451. The Official Action states at page 8 that although the conflicting claims are not identical, they are not patentably distinct from each other because the elimination of a catalyst is an obvious variation. Applicants respectfully traverse.

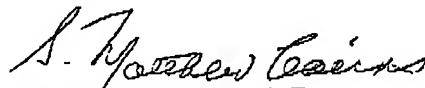
The present claims are directed to a method of *depositing a metal-film on a substrate* using certain compounds of germanium and/or silicon. The '451 patent, on the other hand, is directed to a method of *preparing certain Group IVA compounds*. The claims '451 patent are not at all directed to a method of vapor depositing a metal-containing film and the present claims are

¹ The Official Action at page 8 refers to claims 1-15 of U.S. Pat. No. 7,045,451. It is noted however that this patent only contains 10 claims.

not in any way directed to the preparation of Group IVA compounds. Whether a catalyst is used or not does not change the fact that the claims of the '451 patent are directed to making certain organometallic compounds and not to the use of such compounds. The present claims and the claims of the '451 patent are clearly directed to very different inventions. The only similarity between the present claims and those of the '451 patent are the inclusion of compounds containing silicon or germanium. It is a stretch to say the least to call claims 1-4, 11-12, 14-18 of the present application the same invention or an obvious variant thereof with respect to claims 1-10 of the '451 patent. Applicants submit that this rejection is improper because the rejected claims (of vapor depositing a metal-containing film on a substrate) would in no way provide an improper timewise extension of the right to exclude others from making certain Group IVA compounds granted by the '451 patent. Accordingly, Applicants respectfully request that this rejection be withdrawn.

Favorable consideration in the form of a notice of allowance is respectfully requested.

Respectfully submitted,



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